

# A Review of Amino Acids



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This brief tutorial covers the chemical and structural properties of the 20 Amino Acids commonly found in proteins.

The tutorial contains a number of graphic images, it may take a while to download, so please be patient. After reviewing the amino acids, try out the [Interactive Quiz](#). ☺

**Note:** The quiz requires a browser that recognises Frames and JavaScript, for example - Netscape Navigator 2.0 or above.

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## Amino Acid Properties

Amino acids are the basic structural units of proteins. An alpha-amino acid consists of an amino group, a carboxyl group, a hydrogen atom, and a distinctive R group bonded to a carbon atom, which is called the alpha-carbon because it is adjacent to the carboxyl (acidic) group. An R group is referred to as a *side chain*. (Stryer, 1988)

Amino Acids are commonly classified into the following groups based on the chemical and/or structural properties of their *side chains* :

- Aliphatic Amino Acids
- A Cyclic Amino Acid
- AAs with Hydroxyl or Sulfur-containing side chains
- Aromatic Amino Acids
- Basic Amino Acids
- Acidic Amino Acids and their Amides

## Amino Acid Structures

To view the amino acid structures using [Rasmol](#) click on the appropriate amino acid images below. A script is available ([aacolors](#)) to color the molecules as per the image.

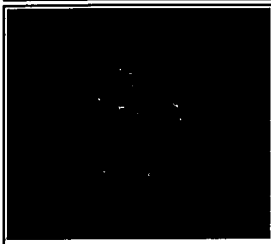


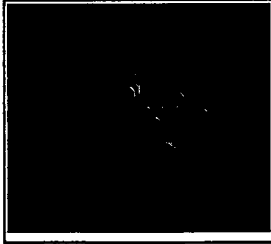
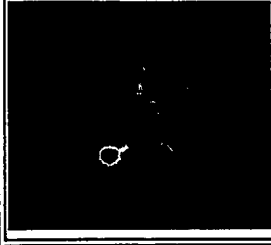
When you are finished viewing the amino acid, type  
**zap** (enter)





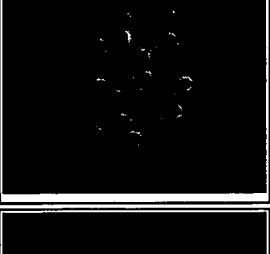

in the command line window to close the current molecule before selecting another amino acid for







viewing. Quit the Rasmol application by typing


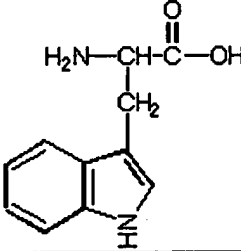

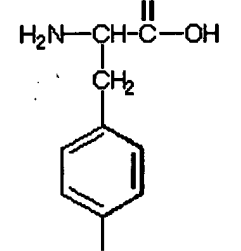
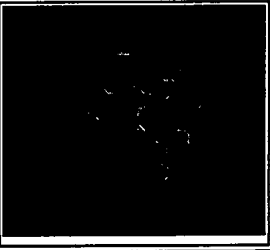
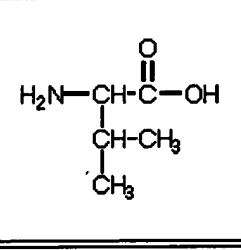
**exit** (enter)

in the command line window. Consult the online [Rasmol Manual](#) if you need further help using Rasmol.

Rasmol Image	Amino Acid	3-letter code	1-letter code	Properties	Structure (un-ionised form)
	Alanine	Ala	A	aliphatic hydrophobic neutral	$\begin{array}{c} \text{O} \\ \parallel \\ \text{H}_2\text{N}-\text{CH}-\text{C}-\text{OH} \\   \\ \text{CH}_3 \end{array}$
	Arginine	Arg	R	polar hydrophilic charged (+)	$\begin{array}{c} \text{O} \\ \parallel \\ \text{H}_2\text{N}-\text{CH}-\text{C}-\text{OH} \\   \\ \text{CH}_2 \\   \\ \text{CH}_2 \\   \\ \text{CH}_2 \\   \\ \text{NH} \\   \\ \text{C}=\text{NH} \\   \\ \text{NH}_2 \end{array}$
	Asparagine	Asn	N	polar hydrophilic neutral	$\begin{array}{c} \text{O} \\ \parallel \\ \text{H}_2\text{N}-\text{CH}-\text{C}-\text{OH} \\   \\ \text{CH}_2 \\   \\ \text{C}=\text{O} \\   \\ \text{NH}_2 \end{array}$
	Aspartate	Asp	D	polar hydrophilic charged (-)	$\begin{array}{c} \text{O} \\ \parallel \\ \text{H}_2\text{N}-\text{CH}-\text{C}-\text{OH} \\   \\ \text{CH}_2 \\   \\ \text{C}=\text{O} \\   \\ \text{OH} \end{array}$
	Cysteine	Cys	C	polar hydrophobic neutral	$\begin{array}{c} \text{O} \\ \parallel \\ \text{H}_2\text{N}-\text{CH}-\text{C}-\text{OH} \\   \\ \text{CH}_2 \\   \\ \text{SH} \end{array}$
	Glutamine	Gln	Q	polar hydrophilic neutral	

					$  \begin{array}{c}  \text{O} \\  \parallel \\  \text{H}_2\text{N}-\text{CH}-\text{C}-\text{OH} \\    \\  \text{CH}_2 \\    \\  \text{CH}_2 \\    \\  \text{C}=\text{O} \\    \\  \text{NH}_2  \end{array}  $
	Glutamate	Glu	E	polar hydrophilic charged (-)	$  \begin{array}{c}  \text{O} \\  \parallel \\  \text{H}_2\text{N}-\text{CH}-\text{C}-\text{OH} \\    \\  \text{CH}_2 \\    \\  \text{CH}_2 \\    \\  \text{C}=\text{O} \\    \\  \text{OH}  \end{array}  $
	Glycine	Gly	G	aliphatic neutral	$  \begin{array}{c}  \text{O} \\  \parallel \\  \text{H}_2\text{N}-\text{CH}-\text{C}-\text{OH} \\    \\  \text{H}  \end{array}  $
	Histidine	His	H	aromatic polar hydrophilic charged (+)	$  \begin{array}{c}  \text{O} \\  \parallel \\  \text{H}_2\text{N}-\text{CH}-\text{C}-\text{OH} \\    \\  \text{CH}_2 \\    \\  \text{C}_5\text{H}_4\text{N}  \end{array}  $
	Isoleucine	Ile	I	aliphatic hydrophobic neutral	$  \begin{array}{c}  \text{O} \\  \parallel \\  \text{H}_2\text{N}-\text{CH}-\text{C}-\text{OH} \\    \\  \text{CH}-\text{CH}_2 \\    \\  \text{CH}_2 \\    \\  \text{CH}_2  \end{array}  $
	Leucine	Leu	L	aliphatic hydrophobic neutral	$  \begin{array}{c}  \text{O} \\  \parallel \\  \text{H}_2\text{N}-\text{CH}-\text{C}-\text{OH} \\    \\  \text{CH}_2 \\    \\  \text{CH}-\text{CH}_3 \\    \\  \text{CH}_3  \end{array}  $
	Lysine	Lys	K	polar hydrophilic charged (+)	

					$\begin{array}{c} \text{H}_2\text{N}-\text{CH}-\text{C}(=\text{O})-\text{OH} \\   \\ \text{CH}_2 \\   \\ \text{CH}_2 \\   \\ \text{CH}_2 \\   \\ \text{CH}_2 \\   \\ \text{NH}_2 \end{array}$
	Methionine	Met	M	hydrophobic neutral	$\begin{array}{c} \text{H}_2\text{N}-\text{CH}-\text{C}(=\text{O})-\text{OH} \\   \\ \text{CH}_2 \\   \\ \text{CH}_2 \\   \\ \text{S} \\   \\ \text{CH}_3 \end{array}$
	Phenylalanine	Phe	F	aromatic hydrophobic neutral	$\begin{array}{c} \text{H}_2\text{N}-\text{CH}-\text{C}(=\text{O})-\text{OH} \\   \\ \text{CH}_2 \\   \\ \text{C}_6\text{H}_5 \end{array}$
	Proline	Pro	P	hydrophobic neutral	$\begin{array}{c} \text{O} \\    \\ \text{C}-\text{OH} \\   \\ \text{HN} \end{array}$
	Serine	Ser	S	polar hydrophilic neutral	$\begin{array}{c} \text{H}_2\text{N}-\text{CH}-\text{C}(=\text{O})-\text{OH} \\   \\ \text{CH}_2 \\   \\ \text{OH} \end{array}$
	Threonine	Thr	T	polar hydrophilic neutral	$\begin{array}{c} \text{H}_2\text{N}-\text{CH}-\text{C}(=\text{O})-\text{OH} \\   \\ \text{CH}-\text{OH} \\   \\ \text{CH}_3 \end{array}$
	Tryptophan	Trp	W	aromatic hydrophobic neutral	

					
	Tyrosine	Tyr	Y	aromatic polar hydrophobic	
	Valine	Val	V	aliphatic hydrophobic neutral	

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